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OTHER MEDIA REVIEW

Paleontology and Evolution in the News

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Abstract This paper is a review of recent media publications and journal articles about evolution and paleontology.

Keywords Mongolia · Tyrannosaur · Court case · Oldest primate · *Purgatorius* · Adaptation · Pliosaur · Svalbard · Oldest turtle · *Drosophila* · Permian · Triassic · Jurassic · Extinction · Hot oceans · Florida · Ancient survivors · Cambrian complex brain · Insects · Plant diversity · Plant evolution · Shell or no shell early animals · Silurian *Australopithecus afarensis* · Lucy · Selam

Mongolian Tyrannosaur—Update

In the previous issue, we mentioned in this column the controversy surrounding the upcoming auction in New York City of a tyrannosaur from Mongolia. The story was covered by numerous news outlets which indicated that the fossil was allegedly illegally obtained and imported from Mongolia and confiscated by Federal agents. The next installment of the ongoing saga came when the importer was charged with smuggling an almost complete skeleton, as well as other fossils, from Mongolia. Within two days, 292 news outlets of all types from around the world ran the story according to Google (www.google.com). An example, typical of the news, was published in the *Canberra Times* written by Suzette Laboy on October 18, 2012 (*A case of the skeleton out of the cupboard*; http://www.canberratimes.com.au/world/a-case-of-the-skeleton-out-of-the-cupboard-20121018-27t32.html). The article contains two excellent images of the controversial skeleton, one of the complete skeleton, the other of its skull, and states that "Eric Prokopi, a self-described "commercial palaeontologist" who buys and sells whole and partial dinosaur skeletons, was arrested on Wednesday at his home in Gainesville [Florida], according to a complaint unsealed by prosecutors. He was charged with smuggling goods into the US and interstate sale and receipt of stolen goods. If convicted on all of the charges, he could face up to 35 years in prison." During his appearance in Federal Court, the judge ordered Prokopi held on $100,000 bond to surrender his passport and be placed under house detention. The Manhattan U.S. Attorney said the "investigation uncovered a one-man black market in prehistoric fossils." The specimen in question was actually sold at the auction for $1.05 million but was seized by the U.S. Government. The lawyer for the accused dealer said that he did nothing wrong. But the government said that the specimen's identity was misrepresented, as well as its origin and value, and that the Mongolian government wanted the 70-million-year-old skeleton of *Tyrannosaurus bataar* back. "Prokopi also is accused of illegally importing from Mongolia the skeleton of a *Saurolophus*, another dinosaur from the late Cretaceous period that he sold to a gallery in California along with fossils of two other dinosaurs native to Mongolia, *Gallimimus* and *Oviraptor mongoliensis*. He also imported the fossilized remains of a *Microraptor*, a small, flying dinosaur from China, the complaint said." The prosecutors said that Prokopi brought the fossils into the country between 2010 and 2012.

Oldest and Most Primitive Primate

Newly discovered fossilized bones of the world's oldest and most primitive primate—*Purgatorius*—reveal a tiny and agile animal that spent much of its time eating fruit and

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climbing trees, researchers say. The headline in *BioNews* (*1st human ancestor looked like squirrel*, published October 20, 2012; http://news.bioscholar.com/2012/10/1st-human-ancestor-looked-squirrel.html). The co-author of the research, Stephen Chester, a Yale University vertebrate paleontologist, said that previously only teeth of the animal had been known but now they have more of the skeleton. He said that the "ankle bones show that it had a mobile ankle joint like primates today that live in trees," giving it a mobility as it moved from tree trunk to branches. "It also shows that the first primates did not have elongate ankles that you see in many living primates today that are thought to be related to leaping behaviors," Chester said. He and his colleagues, Jonathan Bloch of the Florida Museum of Natural History and William Clemens, a professor emeritus at the University of California at Berkeley and a curator for the University's Museum of Paleontology, believe that the specialized ankle bones of *Purgatorious* played a key role in the evolutionary success of early primates. "These new fossils support the idea that the first ten million years of primate evolution happened in the context of an intense period of similar diversification in flowering plants, including the ability to climb in branches and collect fruits and other products of the trees at the very beginning," Bloch said. The animal lived in the Paleocene, soon after the extinction of non-avian dinosaurs. As seen in the accompanying illustration, this mammal is generally believed to have been small and brown, with a bushy tail, and weighing about 1.3 ounces—about the size of the smallest living primate, the mouse lemur of Madagascar. The researchers liken it to another early primate, *Dryomomys*, for which more fossil material is available. "Tree living served this and other primates well, such that all but a few existing species remain at least partly arboreal. Humans are part of the rare exceptions, since our more recent ancestors left the trees some 60 million years after *Purgatorius*' lifetime." One news organization that covered the story is *UK Daily Mail* (UK) on its website Mail Online on October 22, 2012 (*The most primitive primate revealed: How our earliest ancestor resembled a tiny squirrel*; http://www.dailymail.co.uk/sciencetech/article-2221303/The-primitive-primate-revealed-And-ancestor-resembled-tiny-squirrel.html) by Mark Prigg which essentially covered the same ground as the description above but added a few additional comments including that the specimens were originally discovered in what is now eastern Montana's Purgatory Hill, for which the animal was named in 66-million-year-old sediments. The article contains some illustration: one, a previous artist's impress that portrayed the animal as a more land based and a new one more arboreal. As usual in these online articles, the public is invited to submit comments —which are wide-ranging. Of the 104 comments when this item was written, the editors classified them by newest, oldest, best rated, and worst rated. These fossils are found in the same sequence of fossiliferous rocks that tyrannosaurs are found but about 10 feet higher up in the beds. The paper was present at the 72nd Annual Meeting of the Society of Vertebrate Paleontology, Oct. 30 to Nov. 2, 2010.

How Organisms Adapt

The following press release describes research that attempts to find clues of how organisms change their DNA in response to selection pressure. The paper was published by researcher from the University of Veterinary Medicine, Vienna (Vetmeduni, Vienna). However, a search in Google News (www.google.com) of the paper revealed virtually no press coverage. Even so, the press release provided by the University is reprinted here: *Directing change: how do they do it?* (http://www.vetmeduni.ac.at/en/research/research-output/press-releases/fly-adapt-temp/). Since 1859, when Darwin's classic work *On the Origin of Species* was published, we have known that populations change over the course of time. The ability to adapt to changing surroundings is the basis for evolution and is crucial for animals and plants to come to terms with new environmental conditions, for example, as a consequence of climate change. Despite the obvious importance of the process, however, we still do not understand the underlying mechanisms. It is clear that organisms change their DNA in response to selection pressures. But how? Important clues come from the work of Pablo Orozco-terWengel in the group of Christian Schlötterer at the University of Veterinary Medicine, Vienna. The results are published in the current issue of the journal *Molecular Ecology.* In the long run, all organisms must adapt to survive, as their surroundings do not remain constant forever. The major difficulty with understanding adaption relates to the length of time required for experiments: evolution is by its very nature a gradual process. Fortunately, however, recent breakthroughs in experimental evolution using model organisms are providing important insights into the process. The nature of the underlying genetic changes has generally remained elusive, but recent work at the Institute of Population Genetics of the University of Veterinary Medicine, Vienna is helping to show us how evolution may operate. To discover what happens when an organism—in this case, the fruit fly, *Drosophila melanogaster*—is confronted with new conditions for a prolonged period of time, terWengel and colleagues Martin Kapun and Viola Nolte subjected flies to an unfamiliar temperature regime, in which 12-hour days at 28 °C alternated with 12-hour nights at 18 °C. Throughout the experiment, the scientists monitored the changes to the flies' DNA by sequencing pools of female flies taken after certain numbers of generations. The complicated study was made possible by developments in sequencing technology that

enable the rapid sequencing of entire genomes and by new and sophisticated software algorithms that permit the frequency of gene variants (alleles or polymorphisms) to be directly compared across different populations. At the start of the experiment, the fly genomes contained sufficient polymorphisms to enable natural selection to act on the population. The researchers were able to confirm that the genetic changes over time were not random but presumably driven by a selective force: the X chromosome proved to be more stable than chromosome III, for example, despite its far smaller population size (each pair of flies carries a total of four copies of chromosome III but only a single X chromosome). They also showed that genetic changes were widespread and rapid: within a mere 15 generations, the frequencies of variants at nearly 5,000 positions in the genome had altered significantly more than expected. Surprisingly, however, not all changes took place at the same rate. The scientists found that while the frequencies of variants of some genes continued to rise throughout the entire course of the study (37 generations), the proportions of alleles of other genes rose rapidly at the start of the experiment but reached a plateau after about 15 generations. The reasons for this leveling out are still unclear but may relate to the fluctuating temperatures employed in the work, which could result in different selective advantages being conferred by several different alleles of a particular gene. As Schlötterer puts it, "we expected the flies to respond genetically to the changes in their environment. But we did not expect the genetic adaptations to group so neatly into two classes, with so little overlap between them. It will be intriguing to try to find out whether the two categories of gene affect distinct groups of traits" (Orozco-Terwengel et al. 2012).

Pliosaur

Laurel Andrews wrote on October 26, 2012 in the *Alaska Dispatch* (*Terrifying new Jurassic sea predator officially named*; http://www.alaskadispatch.com/article/terrifying-new-jurassic-sea-predator-officially-named). Originally found on the Norwegian island of Svalbard, 800 miles south of the North Pole, the pliosaur, one of the largest marine reptiles identified has been given a scientific name. The skeletons were excavated in 2006 and at the time were given the name "Predator X" because of its size. Between 2007 and 2008 the researchers excavated, cleaned and examined this and another skeleton says Pat Druckenmiller, earth science curator at the University of Alaska's Museum of the North in Fairbanks. Pliosaurs were meat-eating, air-breathing marine reptiles with pear-shaped bodies. They are thought to have mainly preyed on long-necked plesiosaurs, related marine reptiles with similar features, Druckenmiller says. The newly identified pliosaur, *Pliosaurus funkei*, was a gigantic sea predator around 40 feet long, with two pairs of paddle-like limbs that allowed them to speed through the water, and a 6.5-foot long skull. *P. funkei* was the "top predator" of the oceans, Druckenmiller told LiveScience (http://www.livescience.com/24041-ancient-predator-x-sea-monster-named.html) and had "teeth that would have made a *T. Rex* whimper," with a bite estimated four times as strong as the king of the dinosaurs. The specimens they found date back to 140 million years ago. This site also contains an illustration of *P. funkei* preying on a plesiosaur as well as a photograph of the museum team alongside of the huge fossils cast in plaster at the Svalbard site and another illustration that compares the size of the pliosaur with a killer whale and a blue whale. Another story appeared earlier in Wired.com by Brian Switek on October 15, 2012 (http://www.wired.com/wiredscience/2012/10/paleontologists-reveal-identity-of-predator-x/), but which pursues another view of this story and others like it, to wit: "Paleontology often relies on superlatives to entice the public. Fossil species are touted as being the biggest, oldest, strongest, weirdest, or whatever other else applies if the designation will help popularize a discovery. But, sometimes, hype precedes science." He says that regular freeze thaw cycles at the Svalbard locality severely fragmented the skeletons plus other conditions degraded the specimens. "The incomplete nature of both specimens complicates efforts to figure out how big *P. funkei* was. With the smattering of petrified material in hand, Knutsen, Druckenmiller, and Hurum can only estimate the size of their animals based on measurements of other pliosaurs." The result of their work was published in Knutsen et al. (2012). In their conclusion, they state that "It should be noted that a complete vertebral count is unknown for either animal, which could greatly affect this estimate. However, dimensions of other elements (cranium, coracoid) are consistent with that expected for an individual with this range of body length."

Tropical Collapse Caused by Lethal Heat During the Triassic

Do you want to see how many science-oriented blogs there are, just Google (www.google.com) for "Triassic lethal heat." The results are based on a paper by Sun et al. (2012). Although there were almost no print publications (or their online versions) presenting this research work, the blogs that reported this story were all derived in part of full from the press release from Leeds University (http://www.leeds.ac.uk/news/article/3312/tropical_collapse_caused_by_lethal_heat) published October 19, 2012. In part, this is what the press release contains: "Scientists have discovered why the 'broken world' following the worst

extinction of all time lasted so long—it was simply too hot to survive. The end-Permian mass extinction, which occurred around 250 million years ago in the pre-dinosaur era, wiped out nearly all the world's species. Typically, a mass extinction is followed by a 'dead zone' during which new species are not seen for tens of thousands of years. In this case, the dead zone, during the Early Triassic period which followed, lasted for a perplexingly long period: five million years." A study jointly led by the University of Leeds and China University of Geosciences (Wuhan), in collaboration with the University of Erlangen-Nurnburg (Germany), shows the cause of this lengthy devastation was a temperature rise to lethal levels in the tropics: around 50–60 °C on land and 40 °C at the sea surface. The dead zone would have been a strange world—very wet in the tropics but with almost nothing growing. No forests grew, only shrubs and ferns. No fish or marine reptiles were to be found in the tropics, only shellfish, and virtually no land animals existed because their high metabolic rate made it impossible to deal with the extreme temperatures. Only the polar regions provided a refuge from the baking heat.

This broken world scenario was caused by a breakdown in global carbon cycling. In normal circumstances, plants help regulate temperature by absorbing Co2 and burying it as dead plant matter. Without plants, levels of Co2 can rise unchecked, which causes temperatures to increase. Sun and his colleagues collected data from 15,000 ancient conodonts (tiny teeth of extinct eel-like fishes) extracted from two tons of rocks from South China. Conodonts form skeletons using oxygen. The isotopes of oxygen in skeletons are temperature controlled, so by studying the ratio of oxygen isotopes in the conodonts he was able to detect temperature levels hundreds of millions of years ago. Included in the supplemental material of the *Science* report are paleogeographic maps showing fish, marine reptile, and tetrapod latitudinal distribution for Late Permian to Middle Triassic time. In the body of the paper is a chart of Early Triassic diversity of major marine groups and temperature trends. These can be useful in the classroom. Included in the same issue is the perspective of Bottjer (2012; http://www.sciencemag.org.libraryproxy.amnh.org:9000/content/338/6105/336.full.pdf) that the Triassic "global warming interval can provide insights that are relevant to our understanding of the future global warming ocean."

New Fossils Suggest Ancient Origins of Modern-Day Deep-Sea Animals

A paper published in the open access journal PLoSOne on October 10, 2012 describes a collection of fossil animals discovered off the coast of Florida that suggests the present-day deep-sea urchins, starfish, and sea cucumbers not only may have evolved earlier than previously believed but also survived periods of mass extinctions (http://phys.org/news/2012-10-fossils-ancient-modern-day-deep-sea-animals.html). The lead author Ben Thuy said "We were amazed to see that a 114 million year old deep-sea assemblage was so strikingly similar to the modern equivalents." The amazement is the result of the fact that researchers believed that the present-day animals evolved in the relatively recent past. The newly collected fossils described in the study predate the oldest known records of the present-day fauna. According to the authors, this evidence shows that the ancestors of modern deep-sea animals have lived in these deep waters for much longer than previously thought. That this collection of fossils appears to have survived several drastic changes in oceanic climates also suggests that deep-sea biodiversity may be more resilient than shallow-water life forms, and more resistant to extinction events than previously thought. The publication by the Thuy et al. (2012; 10.1371/journal.pone.0046913) can be downloaded in its entirety.

Oldest Turtle in Poland

Another article of interest paleontological was published in the *Daily Mail*'s website MailOnLine by Danien Gayle on October 24, 2012 (http://www.dailymail.co.uk/sciencetech/article-2222429/Fossilised-turtle-shells-Polish-rubbish-dump-turn-oldest-discovered-world.html). Fossilized turtle shells found in Polish rubbish dump turn out to be the oldest yet discovered. The following summary is provided: Tests show the shells date back 215 million years to the Triassic era; a paleobiologist following a hunch discovered them in a landfill site; and now he hopes to continue investigations in the hope of finding a skull. This shell plucked from a Polish dump is also the most complete skeleton yet found claimed the researcher Dr. Tomasz Sulej. "Dating back 215 million years, experts say the shells could provide invaluable clues in solving the riddle of the origin of this ancient reptile which is venerated by cultures across the globe." "The fossil of one of the world's oldest-known turtle shells with a limb bone, was discovered in clay deposit in a rubbish dump north-west of Krakow, Poland." Sulej said that his investigation was led by a hunch that inspired him to poke around a landfill near the town of Poreba—in a region known as the Polish Jurassic Highland—in September 2008. The following sidebar is included: *Bleak Future for Creatures that Walked Earth for Aeons*.

"The bright yellow spokes on the shell of a Radiated Tortoise native to Madagascar catch the eye of school children visiting the Warsaw Zoo. 'They're like army tanks with their heavy armour!' exclaims 12-year-old Wojtek. But the shells that have afforded turtles protection from predators for eons are no match for humans. Hunted for meat,

traditional medicine or caught in the illegal pet trade, this species could become extinct during Wojtek's lifetime. About half of the globe's 328 recognized species of fresh water and marine turtles and land-faring tortoises could vanish in the coming decades, according to the Turtle Conservation Coalition. 'After being here for a couple hundred million years, dozens of species of turtles are now on the verge of extinction, quite simply due to being captured or eaten on an unprecedented scale, particularly in Asia,' says Mariusz Lech, reptile keeper at the zoo. Known to live up to 130 years, these ancient creatures carry deep meaning as primordial symbols of longevity, stability, security and wisdom and feature in creation myths from India to native North America. Yet their future seems bleak. 'Being realistic about the modern-day threats they face, especially in south-east Asia, China, the Philippines, Indonesia or Madagascar, turtles are disappearing fast,' Lech warned. 'Some species could vanish within 20 years if radical steps aren't taken to protect them now.'" Turtles of similar age have been discovered in Germany; the Polish find includes shells, along with neck and tail vertebrae, as well as limb bones that are unique. "We've discovered two species, including one which is unknown," Dr Sulej said. The article contains several images of the fossil turtle and additional images can be found on Google (www.google.com) by searching "oldest fossil turtle" which refer you to numerous but similar reports. You can see the Dr Sulez and his turtle on YouTube (http://www.youtube.com/watch?v=yYCbX3zezdk).

Cambrian Fossil Pushes Back Evolution of Complex Brains

The Christian Science Monitor presented an article on its web site, *Ancient, fossilized, insect-like brain surprisingly complex* by Stephanie Pappas, LiveScience Senior Writer on October 11, 2012 (http://www.csmonitor.com/Science/2012/1011/Ancient-fossilized-insect-like-brain-surprisingly-complex) in which a fossilized brain found in 520-million-year old rocks in China "looks very similar to the brains of today's modern insects" says researcher Nicholas Strausfeld, the director of the Center for Insect Science at the University of Arizona. The specimen in question is a few centimeters long arthropod *Fuxianhuia protensa.* The article discusses whether insects evolved from branchiopods or whether insects, branchiopods, and higher crustaceans evolved from an ancestor with a complex brain, with branchiopods regressing later. The article also describes the search and discovery of the fossil that contains the impression of its brain. http://www.csmonitor.com/Science/2011/1209/Are-you-scientifically-literate-Take-our-quiz "An analysis of the brain revealed it to be in three parts, just as the brains of modern insects are in three parts (known as the protocerebrum, deutocerebrum, and tritocerebrum). Nerves from the eyes extend into the protocerebrum, nerves from the antennaes feed into the ancient creature's deutocerebrum, and a third nerve root from further back in the body extends into the tritocerebrum. "Lots of people don't like that idea, sharing a brain with a beetle, but there's good evidence suggesting that you do," Strausfeld said. The article contains an image of the fossil. The story is based on a press release from the University of Arizona, *Cambrian Fossil Pushes Back Evolution of Complex Brains* by Daniel Stolte, University Communications on October 10, 2012 (http://uanews.org/story/cambrian-fossil-pushes-back-evolution-complex-brains). The release indicates that the researchers argue that the fossil supports the hypothesis that branchiopod brains evolved from a previously complex to a more simple architecture instead of the other way around. This hypothesis arose from neurocladistics, a field pioneered by Strausfeld that attempts to reconstruct the evolutionary relationships among organisms based on the anatomy of their nervous system. Conventional cladistics, on the other hand, usually look to an organism's overall morphology or molecular data such as DNA sequences. An illustration by Nicholas Strausfeld shows the reconstruction of the brain of the 520-million-year-old fossil *Fuxianhuia protensa*, which has a very simple body shape, yet shows unexpected similarity to the complex brain of a modern crustacean, such as the land hermit crab (*Coenobita clypeatus*). Co-authors on the study are Xiaoya Ma and Gregory Edgecombe from the paleontology department of the Natural History Museum, London, and Xianguang Hou, director of the Yunnan Key Laboratory for Paleobiology at Yunnan University. The research was published by Ma et al. (2012).

Insects Drive Plant Evolution

An article published in the Fars News Agency (Teheran) *Insects a prime driver in plant evolution and diversity* (http://english.farsnews.com/newstext.php?nn=9107110806) on October 6 is a copy of the press release from the University of Toronto (Mississauga) but titled *Everyday evolution* (http://www.utm.utoronto.ca/main-news-research-news-general/everyday-evolution), which is not an unusual occurrence. It begins: "Take a good look around on your next nature hike. Not only are you experiencing the wonders of the outdoors—you're probably also witnessing evolution in action", a notion that educators should pass onto their students. The study reported on shows that evolution can happen more quickly than was previously assumed, even over a single generation. "Scientists have long hypothesized that the interaction between plants and insects has led to much of the diversity we see among plants, including crops, but until

now we had limited direct experimental evidence," says Marc Johnson, Assistant Professor in the UTM Department of Biology. "This research fills a fundamental gap in our understanding of how natural selection by insects causes evolutionary changes in plants as they adapt, and demonstrates how rapidly these changes can happen in nature." Johnson and his collaborators from Cornell University, University of Montana and University of Turku in Finland, planted evening primrose, a typically self-fertilizing plant with genetically identical offspring, in two sets of plots. Each plot initially contained 60 plants of 18 different genotypes (plants that contain different sets of mutations). To test whether insects drive the evolution of plant defenses, one set of plots was kept free of insects with a regular biweekly application of insecticide over the entire study period. The other set of plots received natural levels of insects. The plots were left to grow without other interference for five years. Each year, Johnson and his collaborators counted the number and types of plants colonizing the plots. They also analyzed the changing frequencies of the different evening primrose genotypes and the traits associated with these genotypes. Johnson says that evolution, which is simply a change in genotype frequency over time, was observed in all plots after only a single generation. Plant populations began to diverge significantly in response to insect attack in as few as three to four generations. For instance, plants that were not treated with insecticide had increases in the frequencies of genotypes associated with higher levels of toxic chemicals in the fruits, which made them unpalatable to seed predator moths. Plants that flowered later, and thus avoided insect predators, also increased in frequency. Johnson says the findings also show that evolution might be an important mechanism that causes changes in whole ecosystems. "As these plant populations evolve, their traits change and influence their interactions with insects and other plant species, which in turn may evolve adaptations to cope with those changes," says Johnson. "The abundance and competitiveness of the plant populations is changing. Evolution can change the ecology and the function of organisms and entire ecosystems." Additional ecological changes occurred in the plots when insects were removed. Competitor plants, such as dandelion, colonized both sets of plots but were more abundant in plots without insects. This in turn reduced the number of evening primrose plants. The dandelion used more resources and also potentially prevented light from reaching the evening primrose seeds, impacting seed germination. According to Johnson, these ecological changes were the result of the suppression of a moth caterpillar that preferred to feed on dandelion. "What this research shows is that changes in these plant populations were not the result of genetic drift, but directly due to natural selection by insects on plants," says Johnson. "It also demonstrates how rapidly evolutionary change can occur—not over millennia, but over years, and all around us." The research was published by Agrawal et al. (2012). As is usual, the editors suggest additional resources to read that published in older issues of Science.

Which Came First Shells or no Shells?

A rather small size rock, about the size of a golf ball found in the United Kingdom in volcanic ash containing the fossil *Kulindroplax perissokomos* may "resolve the long-lasting dispute about the evolutionary relations of shelled chitons and shell-less Aplacophorans, two classes of mollusk." The relationships are described by Jessica Hallam in the *Yale Daily News* (http://www.yaledailynews.com/news/2012/oct/16/new-fossil-may-end-mollusk-evolution-debate/) on October 16, 2012. The article quotes Bristol University's Jakob Vinter, one of the researchers, who said that traditional hypotheses state that shelled mollusks evolved from their shell-less counterparts. "However, evidence collected over recent years supports the contrary argument, which suggests the worm-like shape of Aplacophorans is a derivative of something much like a chiton. *Kulindroplax* delivers the physical evidence necessary to prove that the worm-like body of the Aplacophorans evolved from shelled chitons." Imperial College London Professor Mark D. Sutton, the lead author of the paper said that "To understand where mollusks fit in the big tree of life you need to understand what the most primitive mollusks looks like." He also said that "*Kulindroplax* has characteristics of both the shelled chitons and shell-less Aplacophorans. Whereas chitons have shells, spicules and a large, flat foot for mobility, Aplacophorans have no shell and no foot, but instead possess a round, wormlike body." To create a three-dimensional image of Kulindroplax's morphology, the researchers had to repeatedly grind away small portions of the fossil and, by photographing the exposed portion of the fossil at micron-length distances, they were able to compile a three-dimensional digital reconstruction of the entire *Kulindroplax* specimen. This virtual image is now all that remains of the fossil, which was completely ground away. The resulting image showed that *Kulindroplax* is an intermediate between shelled and shell-less mollusks, said co-researcher Derek E.G. Briggs, Director of the Yale Peabody Museum of Natural History. "The *Kulindroplax* fossil evidence," Briggs said, "confirms genetic evidence from molecular sequences in DNA and proteins that also refutes the traditional argument" and adds "that he would be surprised if the scientific community did not accept *Kulindroplax* as definitive evidence of the evolutionary history of mollusks." The article was derived in part from a press release from *Yale News* (http://news.yale.edu/2012/10/03/ancient-mollusk-tells-contrary-story) on October 3, 2012. The researchers found the specimen of *Kulindroplax* more than 10 years ago in the

Herefordshire fossil deposit, a rich assemblage of ancient marine life forms more than 400 million years old. About 2 cm wide and 4 cm long, *Kulindroplax* was buried in volcanic ash deposited on the sea floor. The research was published in the Journal Nature by Sutton et al. (2012).

Lucy and Selam's Species Climbed Trees

The press release from the California Academy (http://www.calacademy.org/newsroom/releases/2012/scapula.php) contains the following subtitle "The most comprehensive analysis to date of *Australopithecus afarensis* shoulder blades indicates a partially arboreal lifestyle." The following press release is provided by the California Academy: "*Australopithecus afarensis* (the species of the well-known "Lucy" skeleton) was an upright walking species, but the question of whether it also spent much of its time in trees has been the subject of much debate, partly because a complete set of *A. afarensis* shoulder blades has never before been available for study. For the first time, Midwestern University Professor David Green and Curator of Anthropology at the California Academy of Sciences, Zeresenay Alemseged, have thoroughly examined the two complete shoulder blades of the fossil "Selam," an exceptionally well-preserved skeleton of an *A. afarensis* child from Dikika, Ethiopia, discovered in 2000 by Dr. Alemseged. Further preparation and extensive analyses of these rare bones showed them to be quite ape-like, suggesting that this species was adapted to climbing trees in addition to walking bipedally when on the ground. "The question as to whether *Australopithecus afarensis* was strictly bipedal or if they also climbed trees has been intensely debated for more than thirty years," said Dr. Green. "These remarkable fossils provide strong evidence that these individuals were still climbing at this stage in human evolution." The new findings are published in the October 26 issue of the journal *Science*. Dr. Alemseged, assisted by Kenyan lab technician Christopher Kiarie, spent 11 years carefully extracting the two shoulder blades from the rest of the skeleton, which was encased in a sandstone block. "Because shoulder blades are paper-thin, they rarely fossilize—and when they do, they are almost always fragmentary," said Dr. Alemseged. "So finding both shoulder blades completely intact and attached to a skeleton of a known and pivotal species was like hitting the jackpot. This study moves us a step closer toward answering the question" When did our ancestors abandon climbing behavior? "It appears that this happened much later than many researchers have previously suggested." Selam was a three-year-old *A. afarensis* girl who lived about 3.3 million years ago, and she represents the most complete skeleton of her kind to date. After freeing the shoulder blades from the surrounding rock, Green and Alemseged digitized them using a Microscribe and then took detailed measurements to characterize their shape and function, comparing them to the rare shoulder fossils of other early human relatives: *Homo ergaster* ("Turkana Boy"), *Homo floresiensis* ("The Hobbit"), *Australopithecus africanus*, and two adult specimens of *A. afarensis*. They also made comparisons with an extensive modern sample of juvenile and adult chimpanzee, gorilla, orangutan, and human specimens. The analysis of the shape and function of the bones revealed that *A. afarensis* shoulder blades are apelike, indicating a partially arboreal lifestyle. Drs. Green and Alemseged also found that, like living apes, the shoulder anatomy of juvenile and adult representatives of *A. afarensis* were quite similar. "Human scapulae change shape throughout ontogeny in a significantly different manner than closely related apes," said Dr. Green. "When we compared Selam's scapula with adult members of *Australopithecus afarensis*, it was clear that the pattern of growth was more consistent with that of apes than humans." At the same time, most researchers agree that many traits of the *A. afarensis* hip bone, lower limb, and foot are unequivocally humanlike and adapted for upright walking. "This new find confirms the pivotal place that Lucy and Selam's species occupies in human evolution," said Dr. Alemseged. "While bipedal like humans, *A. afarensis* was still a capable climber. Though not fully human, *A. afarensis* was clearly on its way." The paper was published in *Science* magazine by Green and Alemseged (2012). Science on NBCNews.com (http://www.msnbc.msn.com/id/49556640/ns/technology_and_science-science/#.UI2L04Z69I0) October 25, 2012, contains a photograph of the skull and jawbone of the 3.3-million-year old australopithecine known as "Selam." On the first page of the Google (www.google.com), search for "Selam" will reward the viewer with a series of related images.

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